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ORIGINAL (Red)

APPENDIX I
TECHNICAL IMPRACTICABILITY EVALUATION
FEASIBILITY STUDY REPORT
RUETGERS-NEASE SITE
STATE COLLEGE, PENNSYLVANIA

Prepared for:

Ruetgers-Nease Corporation
201 Struble Road
State College, Pennsylvania

Prepared by:

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Mt. Laurel, New Jersey

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July 1994

Project No.: 923-6112

AR308456

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ORIGINAL (Red)

July 1, 1994

Project No.: 923-6112

U.S. Environmental Protection Agency (3HW24)
841 Chestnut Building
Philadelphia, PA 19107-4431

Attn: Mr. Frank Klanchar
Remedial Project Manager

RE: TECHNICAL IMPRACTICABILITY EVALUATION
CENTRE COUNTY KEPONE SITE, STATE COLLEGE, PA

Gentlemen:

Following our discussion on June 30, 1994, and on behalf of Ruetgers-Nease Corporation (RNC), Golder Associates Inc. (Golder) is pleased to enclose two copies of the Technical Impracticability (TI) Evaluation for the above referenced Site. As you are aware, this document is Appendix I to the Feasibility Study Report, but is provided here as a separate submission, together with referenced figures and tables from the remainder of the FS, to assist USEPA Headquarters review. Sections of FS text referenced in the TI Evaluation are not included in this submission. The reader is referred to the complete FS dated October 15, 1993, and the revisions dated June 1994, if needed.

We trust that this information is sufficient for your present purposes. Please call if we can be of further assistance.

Very truly yours,

GOLDER ASSOCIATES INC.

P. Stephen Finn, C.Eng.
Principal

PSF/lrl

Enclosure

cc: Ralph Pearce, P.E., RNC

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TECHNICAL IMPRACTICABILITY EVALUATION

Introduction

This appendix of the Feasibility Study (FS) evaluates the appropriateness of a Technical Impracticability (TI) waiver for certain chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater, which would otherwise provide the basis for preliminary remediation goals, at the Centre County Kepone Site (the Site) located in College Township, Pennsylvania (see Figure 1-1 of the FS). The Site facilities are shown on Figure 1-2 of the FS. Remedial responses for the Site are currently being evaluated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The National Contingency Plan (NCP) implements the requirements of CERCLA and SARA. The Site is currently in the Remedial Investigation/Feasibility Study (RI/FS) stage of the CERCLA remedial process. A TI determination under the NCP is based primarily upon engineering feasibility and reliability, with cost being a minor factor (unless it is inordinately costly). The ARARs identified as potential groundwater remediation goals comprise Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and background conditions (PaDER).

Site Conceptual Model

The site conceptual model was developed based upon the results of the RI and the baseline risk assessment. Elements of the site conceptual model include:

- Site geology and hydrogeology;
- Constituent source areas, including types and distribution;
- Constituent release mechanisms;

- Constituent transport pathways and fate characteristics; and
- Potential receptors and exposure routes.

The site conceptual model is described in detail in the RI/FS reports and is summarized below for each of the above elements. The summary is focused upon conditions directly relevant to groundwater quality and the TI determination.

Site Geology and Hydrogeology

A comprehensive discussion of the Site geology and hydrogeology is presented in Section 2 of the FS. The Site is located in the Nittany Valley within the Valley and Ridge Physiographic Province of the Appalachian Mountains. A geologic map of the Site is included in Figure 2-1 and geologic cross sections are presented on Figures 2-4 and 2-5. The geologic units underlying the site include a structurally duplicated sequence of carbonate rocks comprising the Loysburg Group and the Bellefonte Dolomite. The Nittany Valley is underlain by a northeasterly-plunging anticline. The Site is located on the southeastern limb of this anticline where carbonate bedrock dips 20 degrees to 25 degrees to the southeast. Bedrock strikes North 50 degrees East to North 60 degrees East. A thrust fault, parallel to regional strike, passes beneath the Site and causes the duplication of the stratigraphic sequence. The Loysburg Group forms an elongate limestone wedge (referred to as the "Loysburg wedge" below) on the footwall of the thrust fault which is parallel to strike and is surrounded by the Bellefonte Dolomite.

A fracture network consisting of early-formed, pre-folding joint sets overprinted by late-formed, post-folding joint sets has been observed in central Pennsylvania (Clark, 1965; Nickelsen, 1979; Hancock and Engelder, 1989; and summarized by Parizek, 1991). Early-formed joint sets bear a clear structural relationship with the fold structures and are oriented in two distinct directions: cross-fold joints that strike northwesterly, and strike joints that parallel northeasterly bedding strike.

Both of these joint sets are intersected by bedding planes at large angles. Pre-fold joints have been recognized at the Site. Cross-fold joints in carbonate rocks are typically highly solutioned, reflecting the initial stage of karst development. Fractures in the Loysburg Group are more heavily solutioned because it is composed of limestone which is less resistant to chemical weathering than the surrounding dolomite. The presence of solution cavities at the Site has been confirmed during drilling (documented in drilling and geophysical logs) and by a recent downhole camera survey. The late-formed, or post-folding joints generally cut across bedding strike and early-formed joints, and are oriented almost due east.

An interpretive potentiometric surface map for the bedrock aquifer is shown on Figure 2-4. Two flow regimes have been interpreted at the site. The areas surrounding the Loysburg wedge are interpreted to be a diffuse flow zone with horizontal hydraulic gradients ranging from 0.25 feet per foot (ft/ft) to 0.33 ft/ft. Groundwater in the diffuse zone is interpreted to flow toward the Loysburg wedge which acts as a local groundwater drain. The Loysburg wedge is interpreted to be a conduit flow zone with discharge at Thornton Spring. The horizontal hydraulic gradient within the Loysburg wedge between the Site and Thornton Spring is approximately 0.005 ft/ft. Measured vertical hydraulic gradients range from 0.099 ft/ft upward to 0.328 ft/ft downward. Vertical gradients might be influenced by the position of the monitored zones relative to the thrust fault, restricted recharge to the shallow flow system due to the local presence of pavement, or local recharge/discharge zones. Pumping tests have been performed at the Site. However, the hydraulic conductivity of the diffuse and conduit flow systems is difficult to evaluate from the results of pumping tests because the pumped wells were open to both the conduit and diffuse flow regimes and are thus measurements of the bulk hydraulic conductivity. These bulk hydraulic conductivity measurements are at the lower end of the range identified in the literature for karst limestone (Freeze and Cherry, 1979). Therefore, the hydraulic conductivity of the conduit zone is likely to be several orders of magnitude greater than that of the bulk hydraulic conductivity measured during the pumping test.

A simplified water budget analysis for the Site vicinity and Thornton Spring indicates that Thornton Spring serves as the outflow point for the majority of the groundwater within the Site vicinity. Groundwater in the Site vicinity is interpreted to primarily flow through the fractures in bedrock. The Loysburg wedge, because of karst solution of its fractures, acts as a natural drain such that groundwater migrates via diffuse fracture flow toward the wedge (i.e. transverse to the wedge's long axis) and then via conduit flow along strike through the wedge until it discharges at Thornton Spring. This conceptual flow regime is shown on Figure 2-8 and 2-10 of the FS.

Constituent Source Areas

The Constituents of Concern (COC) at the Site include volatile organic compounds (VOCs), mirex, and kepone. Potential source areas for impacts to groundwater at the Site were evaluated during the RI based upon previous site operations (see Figure 1-2 of the FS) and a sampling and analysis program for surface soil, subsurface soil, and drainage ditch sediments. A soil gas survey was performed initially and was used to focus the sampling and analysis program for surface and subsurface soils. Analytical data for soils were evaluated using the Summers model to evaluate their potential to impact groundwater quality. Multiple sources were identified throughout the active manufacturing area which exhibited VOCs at concentrations which could impact groundwater quality. Interpreted source areas include:

- Former Drum Staging Area;
- Designated Outdoor Storage Area;
- Area east of Production Building No. 2;

- Area northeast of Building No. 1;
- Tank Farm/Building No. 1 Area;
- Former Spray Field Area; and
- Fresh Water Drainage Ditch.

Although the concentrations of VOCs, mirex, and kepone were higher in certain areas, COCs were detected in all areas which were tested.

COCs likely entered the above source areas via several previous mechanisms which are no longer occurring. These may have included spills and/or leaks of non-aqueous phase liquids (NAPLs) during historical material handling and storage and discharge of treated materials in lagoons and the Former Spray Field Area. The characteristics of the various source areas differ depending upon the COC entry mechanism.

Some COCs may have entered the ground as spills of NAPLs as substantiated by NAPLs having been recovered from wells at the Site. This is a likely entry mechanism in the facility production and storage areas. It is not known if NAPL spills occurred at other areas of the site. NAPLs likely migrated downward through the fine-grained overburden soils in the vadose zone, leaving a trail of residual-phase (immobile) NAPL coating the mineral grains. Depending upon the nature of the spill (i.e., total volume, release rate, viscosity, etc.) and the nature of the subsurface materials (heterogeneity, grain size, moisture content, etc.), the NAPL might reach bedrock where it would flow laterally on top of bedrock until it encountered a fracture. NAPL may have migrated downward through the bedrock fracture until it encountered the water table. NAPLs with a density greater than that of water (DNAPL) may have penetrated the water table, displaced water from these fractures, and migrated to some limited depth and lateral distance from the source, leaving residual-phase DNAPL along the fracture faces. It is likely that during migration, pools of NAPL accumulated in karst solution cavities and dead end fractures both above and below the water table. This is substantiated by 108 gallons of NAPL which were recovered during the first year of operation of the existing groundwater extraction well in the production area of the site. NAPL was also observed in monitoring wells MW-7 and MW-6, which are located downgradient from the active portions of the Site. In addition, natural fluctuations in the groundwater table may have also raised and lowered NAPL within the fractured/karstic bedrock matrix further exposing the NAPL to fractures and cavities.

Some COCs were discharged as treated materials in the Former Spray Field Area, the Chemfix Lagoon, and the Former Earthen Impoundment. It is not clear if NAPLs occur in these areas.

Constituent Release Mechanisms

Constituents are mobilized from the source areas into groundwater by dissolution. Sources in the vadose zone contain both residual NAPLs and adsorbed-phase COCs. Both of these forms dissolve into infiltrating precipitation and are transported downward through the vadose zone to the water table by advective transport. The equilibrium concentrations of dissolved (aqueous-phase) COCs differ for the adsorbed-phase COCs and NAPL COCs. Where NAPLs are present, they are likely to control the aqueous phase concentrations. If multi-component NAPLs are present, the individual component's solubility in groundwater is depressed below that of the pure-component NAPL in accordance with Raoult's Law. Raoult's Law states that the water solubility of an individual component in a multi-component NAPL mixture is proportional to the product of the pure component solubility and its mole-fraction in the NAPL mixture.

Similar to impacted unconsolidated portions of the vadose zone, dissolution would occur by percolation of precipitation through fractures and cavities within the bedrock vadose zone. In addition, fluctuation of the water table would flood fractures and cavities within the deeper portions of the bedrock vadose zone, causing direct dissolution. Any mobile or residual-phase DNAPL which might occur below the water table would undergo continuous dissolution into groundwater. In addition, NAPL trapped within dead end fractures and solution cavities through which groundwater flow is currently inactive (hereafter referred to as inactive cavities) would provide a slower but continuous source of COC available for direct dissolution.

Transport Pathways and Fate Characteristics

COCs which have been mobilized into the groundwater as aqueous-phase constituents migrate hydraulically downgradient by advective-dispersive groundwater transport through fractures in the bedrock toward the Loysburg wedge and, ultimately, along the conduit zone in the wedge toward Thornton Spring. The transport of some COCs is retarded relative to other COCs. The relative mobility of COCs can be evaluated based upon the retardation factor (R), which depends upon various site-specific properties. The relative mobility of the various constituents is estimated in Section 3.2 of the FS. Some natural attenuation of COCs (dispersion, dilution, hydrolysis, volatilization, and biodegradation) occurs as they migrate toward Thornton Spring.

Potential Receptors and Exposure Routes

Potential receptors and exposure routes for COCs were evaluated by the baseline risk assessment (Environ, 1993). Potential exposure routes were evaluated for human and wildlife receptors under current land use and hypothetical future land use scenarios. Potential human receptors and exposure routes for groundwater under the current (and future) land use scenario include:

- Off-Site residents (including children) potentially exposed to COCs in surface water, sediment, and air at Thornton Spring via dermal adsorption, ingestion, and inhalation;
- Off-Site residents and hypothetical on-Site residents potentially exposed to COCs in domestic wells via dermal contact, ingestion, and inhalation; and
- Recreational visitors potentially exposed to mirex and kepone in Spring Creek surface water, sediment, and biota via dermal contact and ingestion.

The estimated risks for adverse health effects for most of these scenarios were within the range specified within the NCP as acceptable. Hypothetical future use of groundwater for domestic water supply, although extremely unlikely, was determined to have a risk of adverse health effects which exceeds the acceptable range specified in the NCP. However, areas downgradient of the Site are supplied by municipal water service, and institutional controls prohibiting future groundwater use will be developed for the Site.

Potential wildlife receptors are not exposed directly to impacted groundwater but are indirectly exposed after impacted groundwater discharges through Thornton Spring and flows in to Spring Creek. Potential risks to aquatic life in Thornton Spring are calculated based upon surface water and sediment chemistry data but impacts have not been documented. Fish do not inhabit the drainage channel from the spring to Spring Creek and the spring provides a limited habitat for potential terrestrial predators. Water from the spring passes through a culvert and the point of entry into Spring Creek is elevated above the creek. No Site-related adverse impacts to macroinvertebrates, fishes, or terrestrial predators in Spring Creek have been observed.

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Evaluation of Restoration Potential

The potential to restore Site groundwater to background conditions has been evaluated based upon the conceptual model for the Site, published performance data for similar cases, and an evaluation of the performance of the existing groundwater remedial systems at the Site. Experience over the last decade with groundwater corrective actions at other sites indicates that restoration of groundwater to Safe Drinking Water Act Maximum Contaminant Levels (MCLs) may not be achievable (USEPA, 1989; Travis and Doty, 1990; Harley et al., 1991; Nyer, 1993; USEPA, 1993). Restoration to background is even more difficult. Many factors can inhibit restoration of groundwater to MCLs or to background conditions. These factors can be grouped into three categories:

- Hydrogeologic factors;
- Contaminant-related factors; and
- Remediation system design inadequacies.

Inhibiting hydrogeologic factors at the Site include the presence of fractured bedrock and karst solution cavities. Hydrogeologic conditions of this nature are among the most difficult in which to achieve groundwater restoration due to non-uniform flow conditions and the potential presence of COCs in dead end fractures which cannot be accessed for recovery. USEPA (1993) indicates that complex fracturing of bedrock aquifers makes recovery of NAPL extremely difficult, and suggests that this would justify specification of TI in a Record of Decision (ROD). COCs present in dead-end fractures and inactive solution cavities above and below the water table are not directly exposed to active groundwater flow zones during groundwater extraction system operation. COCs trapped in such cavities would be further isolated from active groundwater flow zones as the water table is lowered through groundwater extraction.

Contaminant-related factors at the Site center upon the presence of NAPLs which can occur in both mobile (recoverable) and immobile (unrecoverable, or residual) forms. Excavation is the only current technology which has been proven for removal of all NAPL, and excavation is clearly not practicable at this site as NAPL is contained within the bedrock. Residual-phase NAPL is held by capillary forces and cannot flow to a recovery well. However, it can dissolve into the adjacent aqueous phase and migrate via advective-dispersive flow. It is probable that small pools of DNAPL occur locally in depressions on the bedrock surface or in karst solution cavities in bedrock. The locations of potential NAPL pools in karst solution cavities and dead end fractures are extremely difficult to establish and such pools act as a source for aqueous-phase constituents for long periods of time until all of the NAPL dissolves. Pools of DNAPL might migrate as a separate non-aqueous phase depending upon local factors and therefore might be partially recoverable using extraction wells. However, 30 to 90 percent of the original NAPL is likely to be unrecoverable by extraction wells (Newell et al., 1991). Residual (and mobile) NAPL can continue to dissolve into groundwater for tens to hundreds of years.

The performance of the existing groundwater remedial systems at the Site provides useful information to evaluate the likely performance of the final groundwater remedy. Analysis of monitoring data for the existing groundwater remedial systems at the Site indicates that although significant reductions in COC concentrations initially occurred in some of the wells, COC concentrations have been relatively consistent and above remediation goals even after additional extraction wells became operational (see Figures I-1 and I-2). This is probably due to slow dissolution of NAPL, which could continue for a long period of time, and slow diffusion of COCs out of the bedrock matrix, dead-end fractures and inactive solution cavities into the zones where groundwater is currently extracted. There has been relatively little reduction at other wells (see Figures I-3 and I-4). Similar behavior can be expected for additional extraction wells which are installed to enhance the performance of the existing remedial system (i.e., initial reductions in COC concentrations are expected, ultimately leveling off to concentrations above the MCLs and background conditions).

Source areas for impacts to groundwater have been identified. These sources will be removed or treated using soil vapor extraction to the extent practicable or contained by capping and source control groundwater extraction wells (see Section 7 of the FS). NAPL zones at the site have been assessed based upon recovery of NAPL from monitoring wells, review of historical handling, storage, and disposal practices, and evaluating the degree of saturation of aqueous groundwater samples with respect to the solubility of various COCs. This assessment indicates that the majority of the plant property may contain NAPL and that NAPL has traveled within the bedrock mass laterally away from the identified original source areas (e.g., to MW-7). It is believed that a significant proportion of NAPL may be contained within the fractured karstic bedrock which cannot be effectively removed given the current status of remedial technology. Containment technologies, such as those evaluated for the Site, would reduce leaching associated with precipitation infiltrating through the bedrock vadose zone in these areas.

The total mass of NAPL present in the subsurface is not known so that the time required for remaining NAPL to dissolve into groundwater cannot be reliably calculated. It is also not known how much of the NAPL is mobile and recoverable with extraction wells. Therefore, it is difficult to estimate the timeframe necessary to restore groundwater quality at the Site. Calculations presented in Appendix E using the batch flush model indicate that restoration timeframes for the existing aqueous-phase COCs might be on the order of 57 years. These calculations may underestimate likely remedial timeframes because they do not consider diffusion-controlled transport of COCs or the presence of NAPL within the bedrock matrix which will continue to (albeit slowly) release COCs to the aqueous phase.

Remedial technologies for groundwater were evaluated in Sections 5 through 7 of the FS. No other remedial technologies were identified which could restore groundwater quality more rapidly than extraction of impacted groundwater.

The estimated present worth cost for groundwater extraction and treatment are presented in Section 7 of the FS and total $9,000,000 for 30 years of operation and maintenance of the system. Issue of a TI waiver will not affect estimated remedial costs because source control and migration management groundwater extraction wells are necessary to contain the bedrock source areas, to prevent further off-Site migration of the aqueous-phase COCs, and to potentially restore groundwater quality in the attainment area.

ARAR's to be Waived

The NCP states that "EPA expects to return useable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site" (40 CFR Part 300.430(a)(1)(iii)(F)). Groundwater cleanup levels are established through analysis of ARARs and risk-based calculations to assess levels which are protective of human health and the environment. The Commonwealth of Pennsylvania hazardous waste regulations contain requirements for groundwater corrective actions (25 PA Code, Chapter 264.100(a)(9)) which are potentially applicable to the Site. These corrective action requirements specify that groundwater should be restored to background conditions. COCs at the Site are synthetic organic compounds such that background concentrations would be set at the detection limit of routine monitoring protocol. COCs detected in on-Site groundwater are presented, along with representative statistical information, in Table 4-3. However, based upon Site conditions (karst geology), the nature of the sources (NAPL), published performance data for similar groundwater restoration cases, and the evaluation of the performance of existing groundwater remedial systems, groundwater restoration to background conditions in on-Site areas is considered to be technically impracticable. Such a TI determination would apply to all COCs listed in Table 4-3.

Spatial Extent of Technical Impracticability Zone

The spatial extent of the TI zone would encompass all of the Site property because NAPLs have been detected in multiple, widespread areas of the Site. The TI zone does not include the attainment area downgradient of the Site property boundary at this time. The practicability of restoring groundwater quality in the attainment area will be evaluated following implementation of the groundwater remedy and collection of performance monitoring data.

Alternative Remedial Strategy

Alternative remedial strategies should address three types of problems:

- Prevention of exposure to impacted groundwater;
- Remediation of source areas; and
- Remediation of aqueous phase constituents.

Prevention of exposure to impacted groundwater can be accomplished through institutional controls such as deed and/or zoning restrictions. As discussed above, the only current exposure pathway for groundwater is via surface water at Thornton Spring and Spring Creek. In both cases, current exposures do not constitute unacceptable risks. Areas downgradient of the Site are currently serviced by municipal water. Institutional controls will be developed for the Site to prohibit future development of Site groundwater.

Source areas should be identified and treated or removed where feasible if significant risk reduction will result. However, complete source removal or treatment is not feasible as COCs are believed to be contained within unconsolidated deposits below buildings and structures and within cavities and fractures of the bedrock matrix, both above and below the water table. Given the status of remedial technology, there are no current means for effectively removing or treating all of these source areas. Therefore, source containment is necessary. Containment will limit further spread and impacts to groundwater, enhance the potential for restoration of the aqueous-phase in the off-Site attainment area, and facilitate potential future use of innovative source removal technologies.

Some of the identified source areas can potentially be removed and/or treated using soil vapor extraction. These include sediments in the Freshwater Drainage Ditch, soils in the Tank Farm area and Designated Outdoor Storage Area and any NAPL which can be recovered by the source control groundwater extraction wells which would surround the production area. Approximately 108 gallons (903 pounds) of NAPL were recovered during the first year of operation of the existing groundwater extraction system at the Site. No significant quantities of NAPL have been recovered during subsequent years.

It is believed that the most effective means for addressing multiple widespread sources will be containment via a low permeability cover system, source control groundwater extraction wells in the production area, and migration management groundwater extraction wells at the downgradient edge of the Site property boundary. A monitoring program will be implemented to assess the effectiveness of the containment systems.

The aqueous phase plume extends off-site to Thornton Spring within the Loysburg wedge. The aqueous phase plume is interpreted not to extend outside of this wedge. The remedial objective for the aqueous phase plume is restoration of this zone to its beneficial uses (i.e., drinking water quality). However, it should be noted that aquifer restoration of aqueous-phase COCs in fractured bedrock settings also might be technically impracticable.

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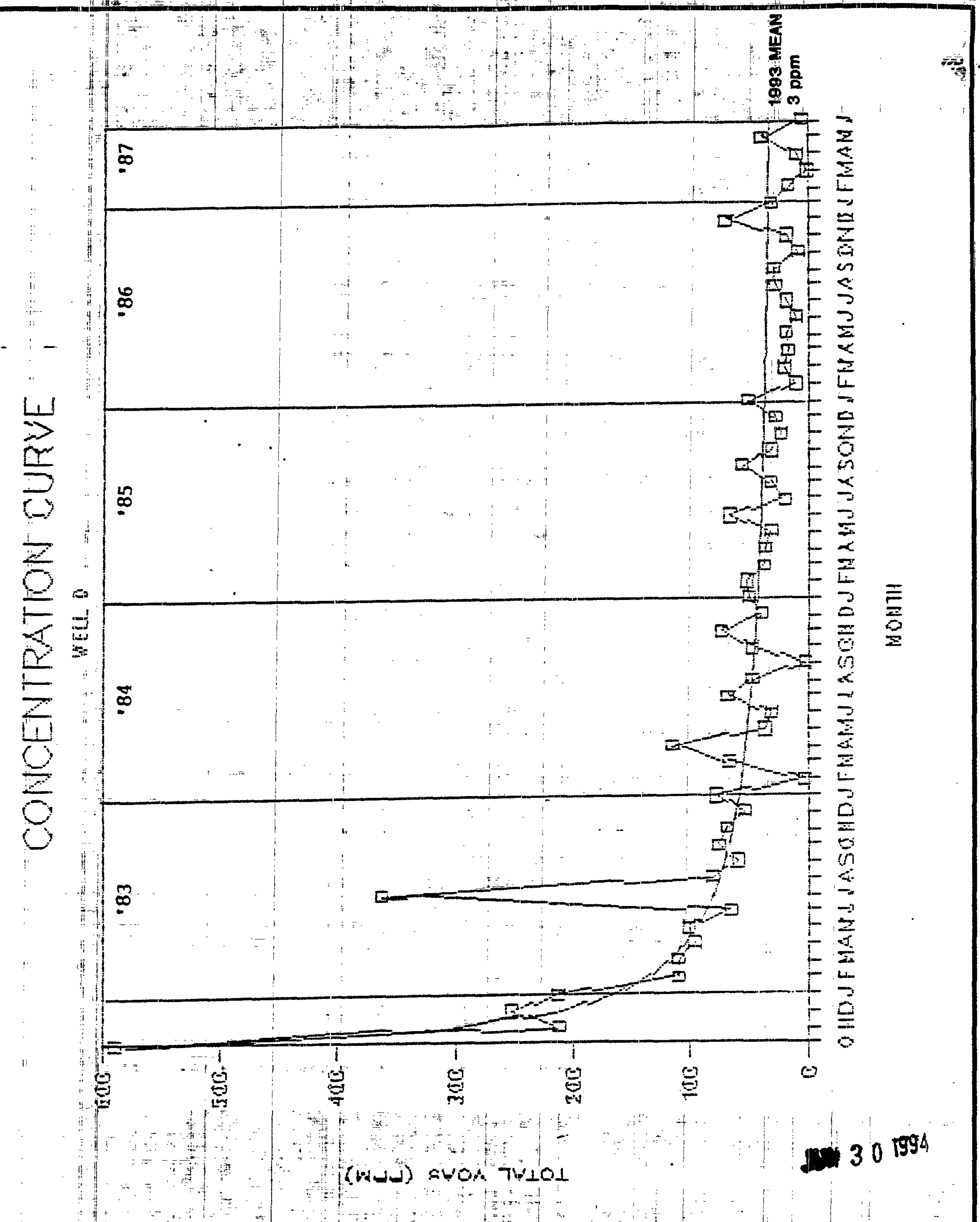

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JOB No.:	923-6112	SCALE:	N/A	**VOC CONCENTRATION TRENDS IN WELL O**
DR BY:	MRM	DATE:	06/27/94	
CHK BY:	RMG	FILE No.:	PA17-232	
REV BY:	RSW	DR SUBTITLE:	02	

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FIGURE **I-1**

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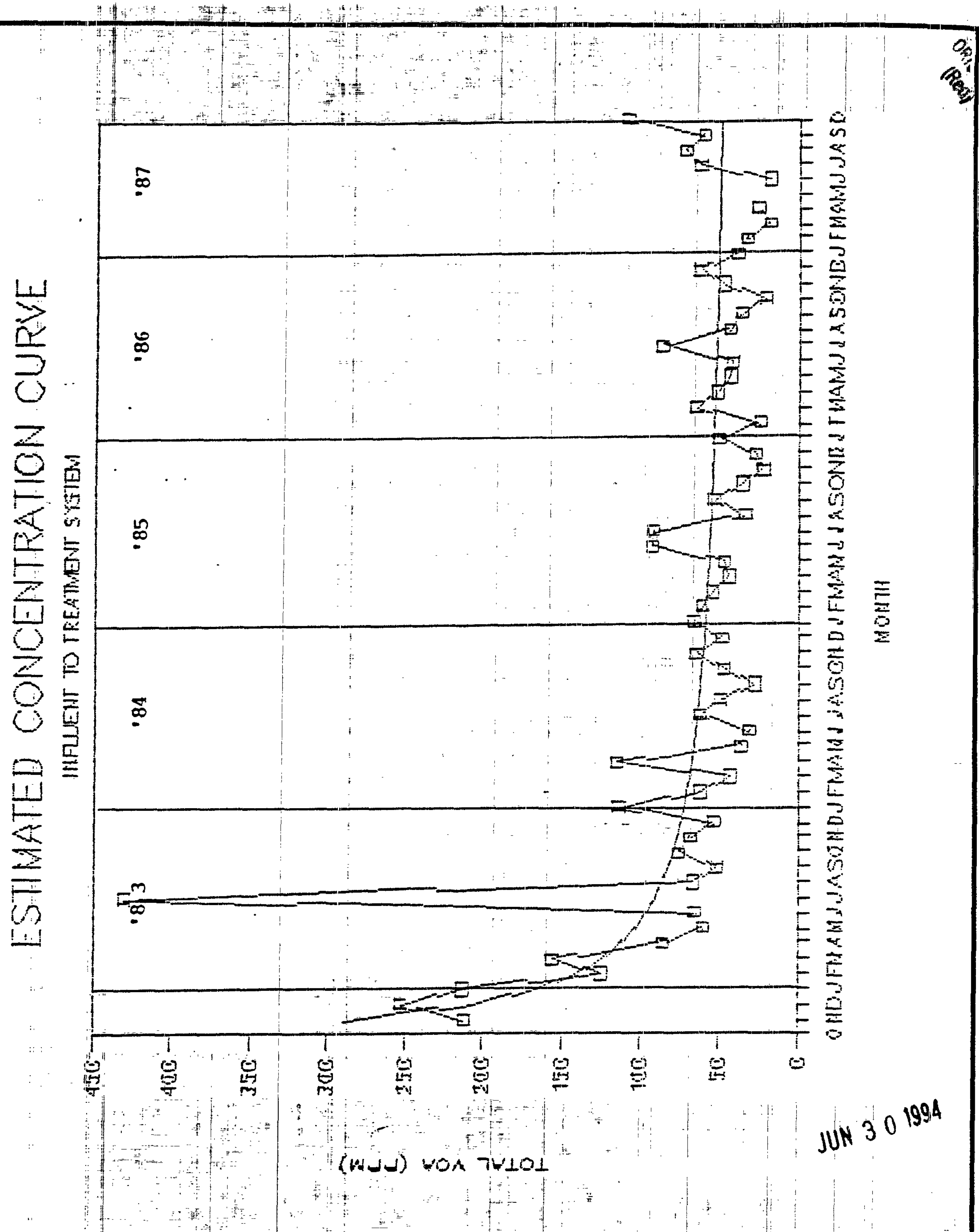
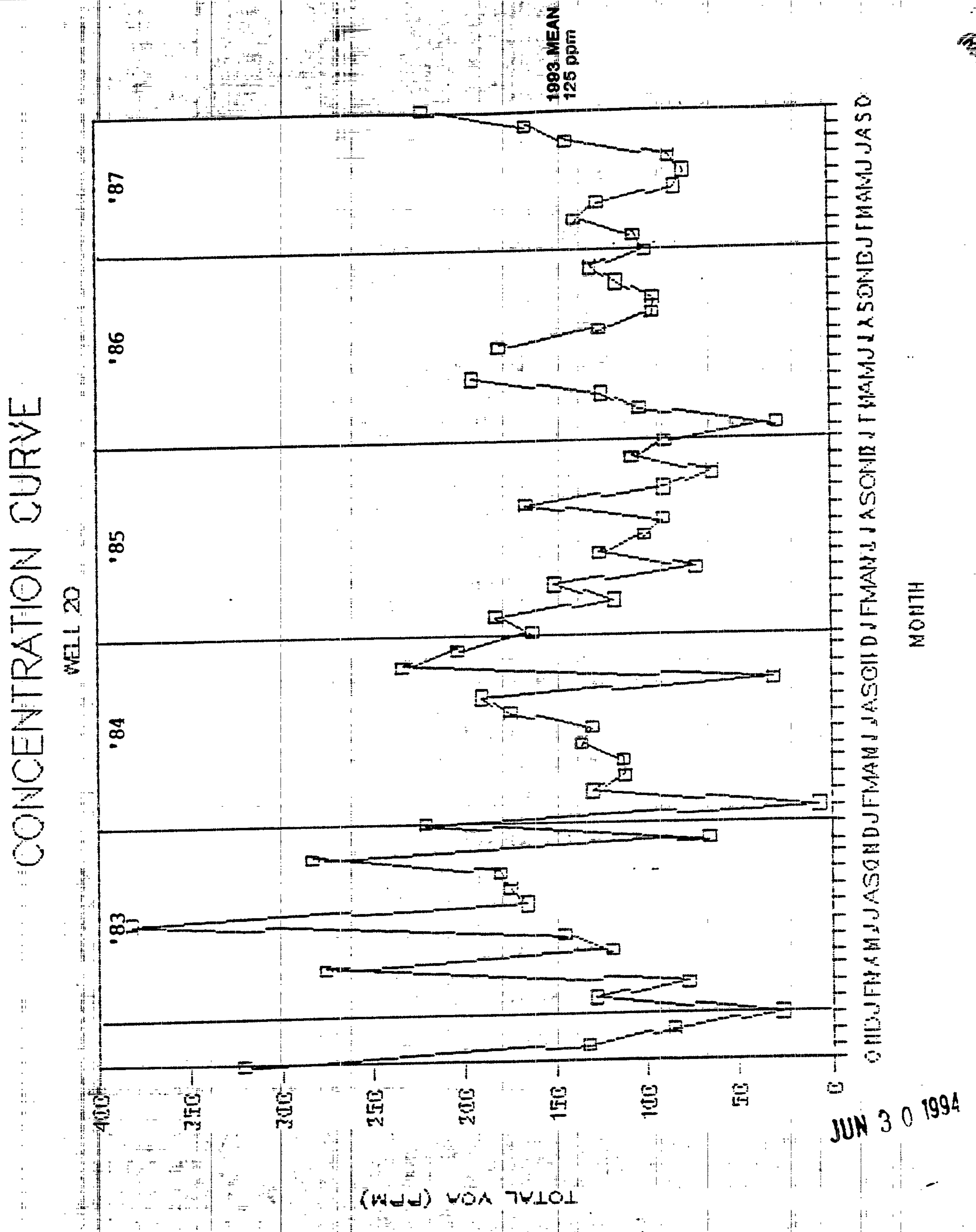


JUN 30 1994

JOB No.:	923-6112	SCALE:	N/A	**VOC CONCENTRATION TRENDS IN TREATMENT SYSTEM INFLUENT**
DR BY:	MRM	DATE:	06/27/94	
CHK BY:	RMG	FILE No.:	PA17-233	
REV BY:	RSW	DR SUBTITLE:	02	
Golder Associates				RUETGERS-NEASE CORPORATION — FIGURE I-2



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JOB No.:	923-6112	SCALE:	N/A
DR BY:	MRM	DATE:	06/27/94
CHK BY:	RMG	FILE No.:	PA17-234
REV BY:	RSW	DR SUBTITLE:	02

VOC CONCENTRATION TRENDS IN WELL 20

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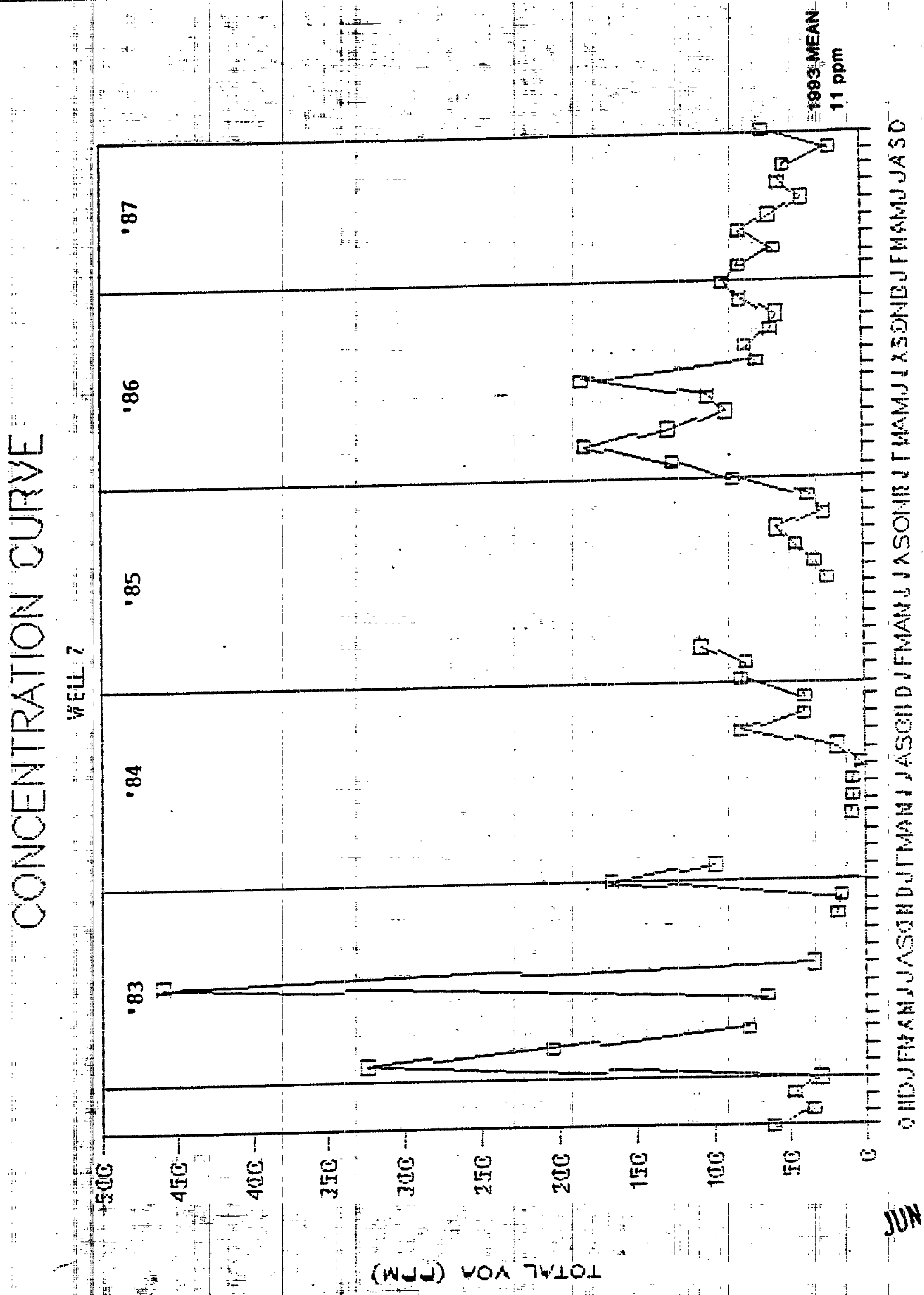
FIGURE I-3

AR308475



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JOB No.:	923-6112	SCALE:	N/A	VOC CONCENTRATION TRENDS IN WELL 7
DR BY:	MRM	DATE:	06/27/94	
CHK BY:	RMG	FILE No.:	PA17-235	
REV BY:	RSW	DR SUBTITLE:	02	

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TABLE 4-3

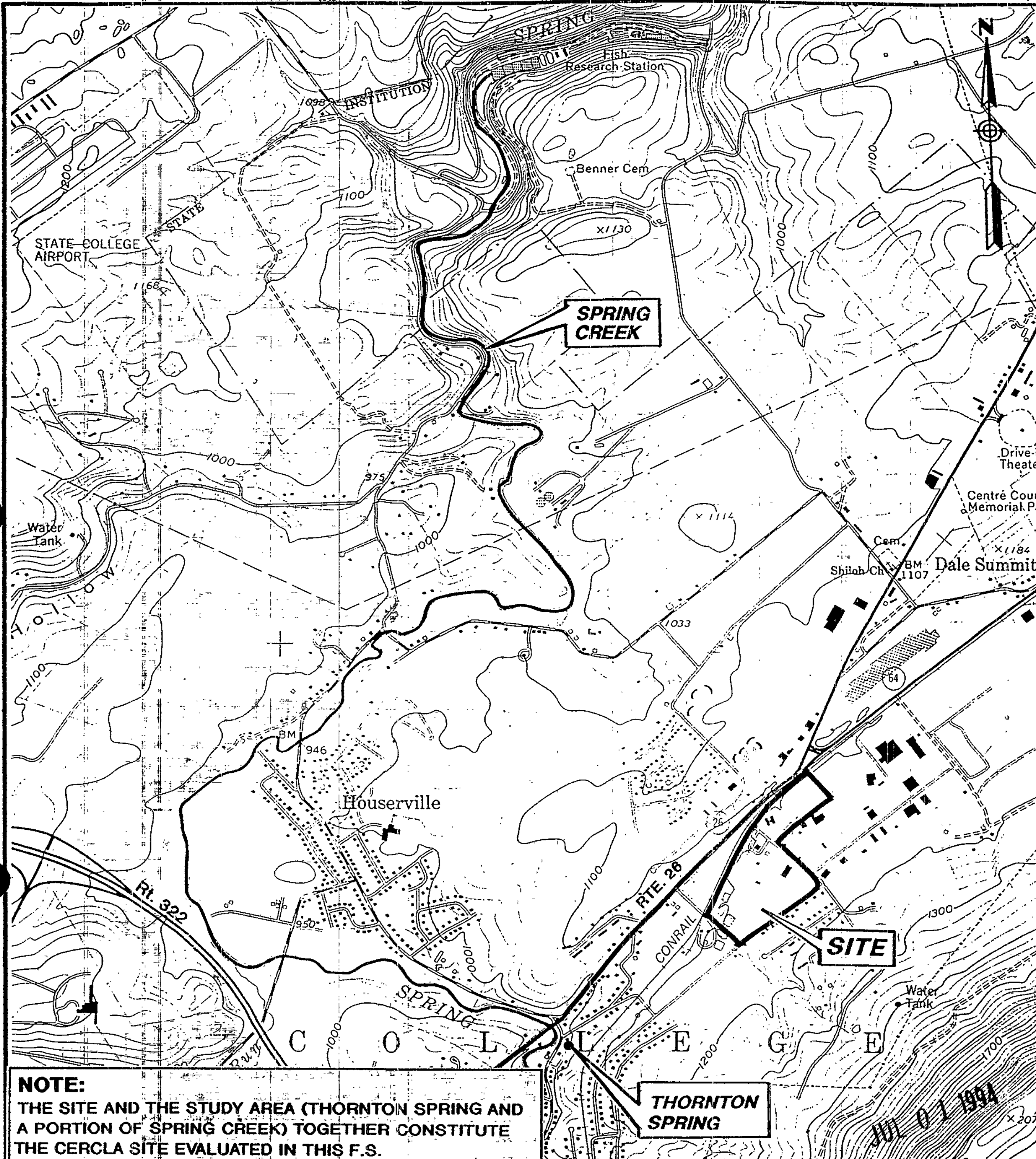
CHEMICAL SPECIFIC ARARs - GROUNDWATER (1)

CONSTITUENT INFORMATION						FEDERAL SAFE DRINKING WATER ACT (3)	PENNSYLVANIA STATE WATER ACT (4)
	Constituent:	Frequency of Detects (2) (Number of Detects per Number of Samples)	Minimum Concentration of Constituent (ug/l)	Mean Concentration of Constituent (ug/L)	Maximum Concentration of Constituent (ug/L)	MCLGs (ug/l)	MCLs (ug/l)
CAS No.	Authority:	Final RI Report 12/23/92				40 CFR Part 141.50-141.52	PA CODE TITLES Title 25 Chapter 109.202
GROUNDWATER							
67-64-1	ACETONE	9/40	3	583	1400		
71-43-2	BENZENE	20/40	1	497	19000	zero	5
108-90-7	CHLOROBENZENE	8/40	2	20	300	100	100
540-90-0	1,2-DICHLOROETHENE (total)(5)	20/40	3	1445	19000	70/100	70/100
100-41-4	ETHYLBENZENE	16/40	1	565	16000	700	700
79-34-5	1,1,2,2-TETRACHLOROETHANE	16/40	1	12078	260000		
127-18-4	TETRACHLOROETHENE	16/40	1	277	6400	zero	5
108-88-3	TOLUENE	18/40	1	7926	250000	1000	1000
79-00-5	1,1,2-TRICHLOROETHANE	4/40	1	2.4	3	3	5
79-01-6	TRICHLOROETHENE	24/40	2	4700	8200	zero	5
75-01-4	VINYL CHLORIDE	14/40	1	65	930	zero	2
1330-20-7	XYLENES (total)	18/40	1	5294	130000	10000	10000
143-50-0	KEPONE	12/31	0.0904	3.36	95.7		
2385-85-5	MIREX	17/33	0.0015	35.2	1140		

NOTES:
(1) The requirements of 25 PA Code Chapter 264.100(a)(9) which require restoration to background may be applicable.
(2) Detection frequency is based on the total number of groundwater samples
(3) The NCP (40CFR Part 300.430(e)(2)(i)(B) and (C)) requires attainment of non-zero MCLGs, when they are relevant and appropriate, or MCLs when MCLGs do not exist or are equal to zero, for CERCLA groundwater remedial actions involving current or potential future sources of drinking water.
(4) Federal MCLs have been adopted by the Commonwealth of Pennsylvania (Title 25, PA Code Chapter 109.202).
(5) cis value/trans value

AR308477

2



NOTE:
THE SITE AND THE STUDY AREA (THORNTON SPRING AND A PORTION OF SPRING CREEK) TOGETHER CONSTITUTE THE CERCLA SITE EVALUATED IN THIS F.S.

REFERENCE:
TOPOGRAPHY TAKEN FROM THE STATE COLLEGE U.S.G.S. QUADRANGLE, PENNSYLVANIA - CENTRE CO., 7.5 MINUTE SERIES, PHOTOREVISED 1987.

PENNSYLVANIA
QUADRANGLE LOCATION

2000 0 2000
scale feet

JOB No.:	923-6112	SCALE:	AS SHOWN
DR BY:	EAM	DATE:	07/19/93
CHK BY:	RSW	FILE No.:	PA17-171
REV BY:	[illegible]	DR SUBTITLE:	02

SITE AND STUDY AREA LOCATION MAP

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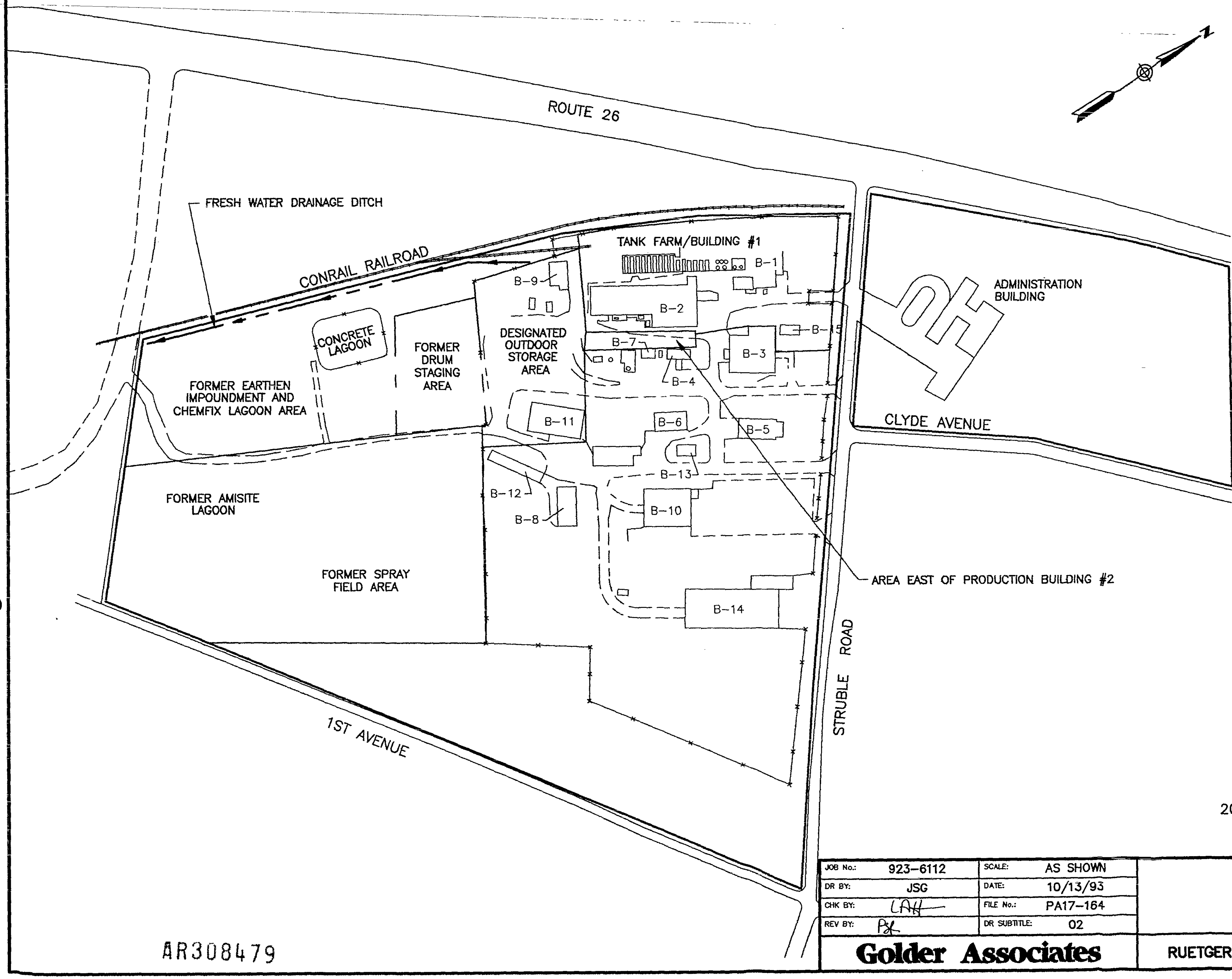
RUETGERS-NEASE CORPORATION

FIGURE 1-1

AR308478



LEGEND

- APPROXIMATE PROPERTY LINE
- DRAINAGE DITCH
- CYCLONE FENCE
- RAILROAD TRACKS
- B-6 BUILDING

BLDG. NO.	DESCRIPTION
B-1	MAIN PROCESSING AREA
B-2	WAREHOUSE & PROCESSING
B-3	WAREHOUSE
B-4	DISTILLATION BUILDING
B-5	MAINTENANCE BUILDING
B-6	BOILER HOUSE
B-7	PROCESSING AREA
B-8	EQUIPMENT STORAGE
B-9	GROUNDWATER TREATMENT FACILITY
B-10	WAREHOUSE
B-11	HAZARDOUS WASTE STORAGE SHELTER
B-12	DRUM STORAGE SHELTER
B-13	MECHANICAL STORAGE
B-14	OFFICE & STORAGE
B-15	LUNCHEON BUILDING

REFERENCE

1.) ORIGINAL DRAWING TAKEN FROM SMC ENVIRONMENTAL GROUP, DRAWING No. 077 9723 90011 DATED 07/01/92.

JUL 0 1 1994

200 0 200
scale feet

JOB No.:	923-6112	SCALE:	AS SHOWN
DR BY:	JSG	DATE:	10/13/93
CHK BY:	LAH	FILE No.:	PA17-164
REV BY:	PK	DR SUBTITLE:	02

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ON-SITE AREAS

RUETGERS-NEASE CORPORATION

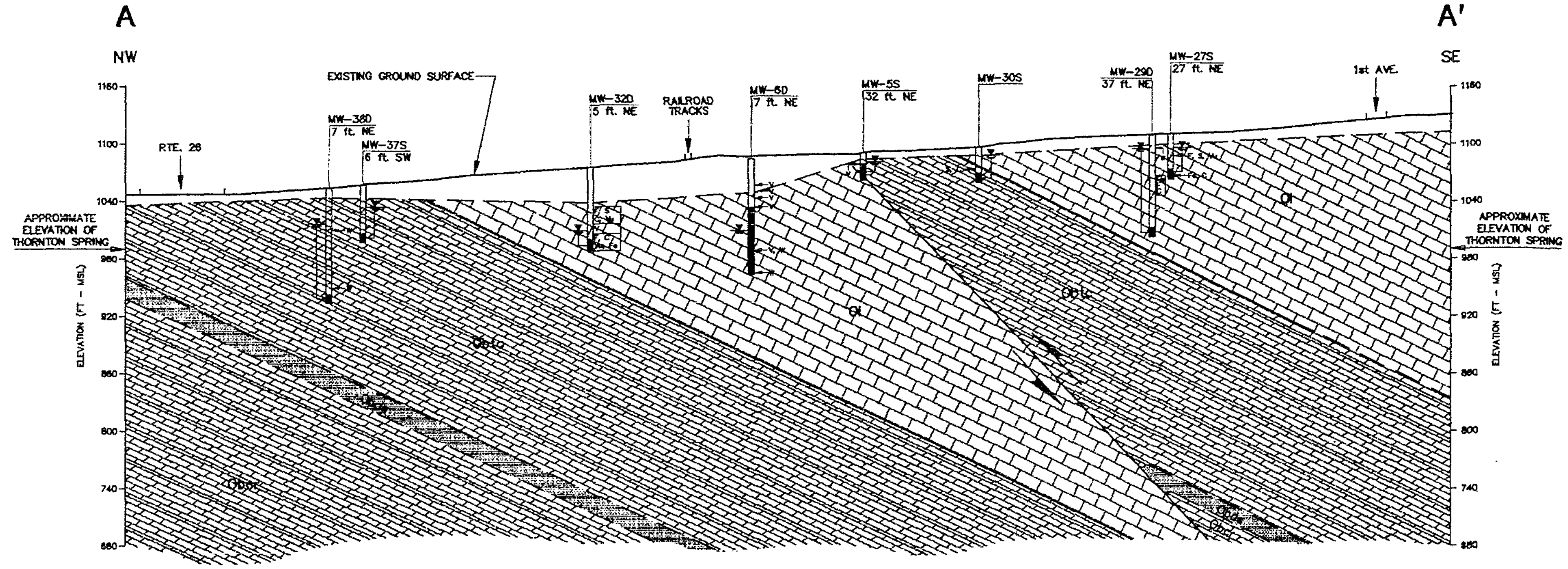
FIGURE 1-2

AR308479

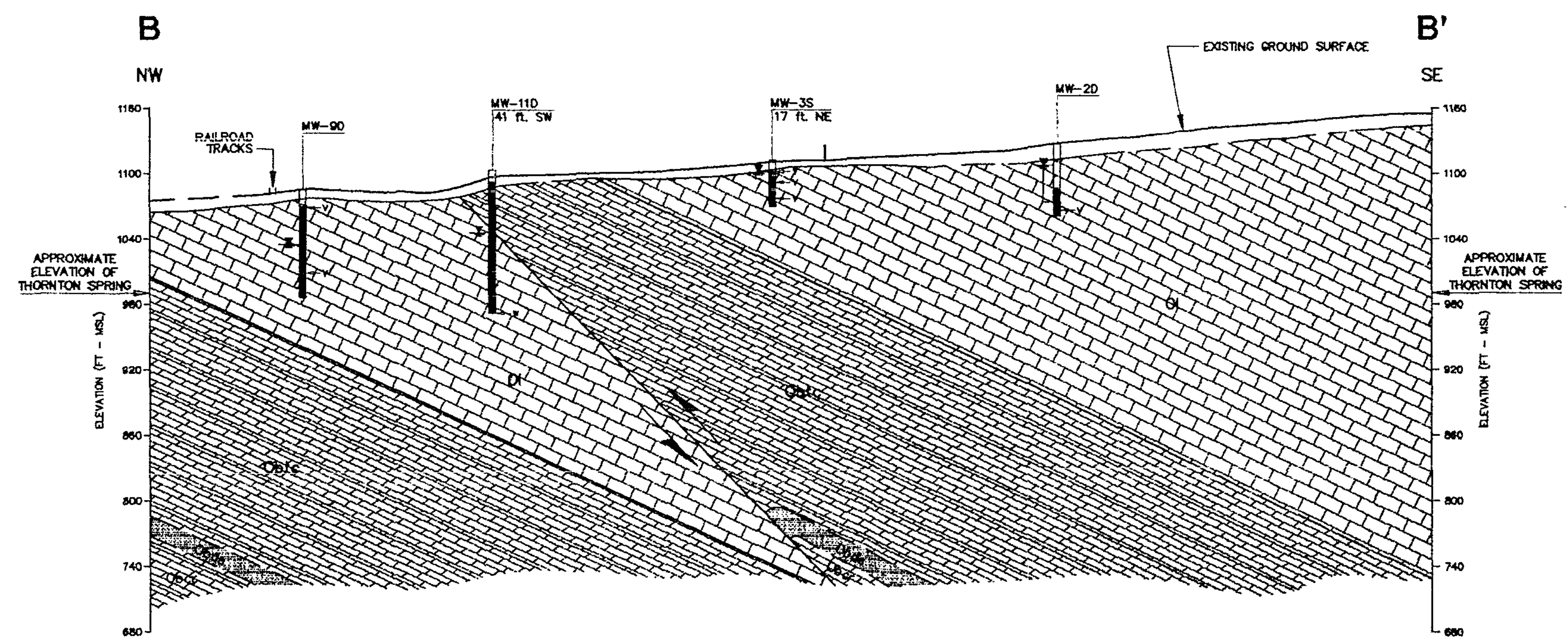
UNSCANNED ITEM(S)

TO VIEW THE ITEM(S), CONTACT THE
SUPERFUND RECORDS CENTER

C:\DWG\9236112\pa17190.DWG| C68-JSG| 10-14-93 11:55P| 1=1



A GEOLOGIC CROSS SECTION A-A'
2-1 2-3
60 0 60 120
scale feet



B GEOLOGIC CROSS SECTION B-B'
2-1 2-3
60 0 60 120
scale feet

LEGEND

CROSS SECTION DESIGNATION
FIGURE No. WHERE CROSS SECTION IS PRESENTED
FIGURE No. WHERE LOCATION OF CROSS SECTION IS FIRST SHOWN

MW-38D — BOREHOLE LABEL
7 ft. NE — PROJECTED DISTANCE

FEATURES ENCOUNTERED DURING DRILLING OF BOREHOLE
W = WATER
V = VOID
F = FRACTURE
S = SOLUTIONING
C = SECONDARY CALCITE
VU = VUGS
Fe = IRON STAINING

TOP OF BOREHOLE
MONITORING INTERVAL
BOTTOM OF BOREHOLE

SURFICIAL SOIL: UNDIFFERENTIATED COLLUVIUM AND FILL

Ol — LOYSBURG GROUP: GRAY LIMESTONE AND DOLOMITIC LIMESTONE

Obtc — TEA CREEK MEMBER OF THE BELLEFONTE DOLOMITE: FINE GRAINED, MEDIUM LIGHT GRAY DOLOLUTITE

Obcr — COFFEE RUN MEMBER OF THE BELLEFONTE DOLOMITE: INTERBEDDED FINE TO MEDIUM GRAINED DOLOMITE

Obds — DALE SUMMIT MEMBER OF THE BELLEFONTE DOLOMITE: FINE TO COARSE GRAINED CONGLOMERATE SANDSTONE

WATER LEVEL (MEASURED MARCH 1992)

THRUST FAULT SHOWING SENSE OF MOVEMENT

LITHOLOGIC CONTACT (DASHED WHERE INFERRED)

REFERENCE

1.) BOREHOLE LITHOLOGIC LOGS AND MONITORING WELL CONSTRUCTION LOGS OBTAINED FROM APPENDIX C OF THE SMC ENVIRONMENTAL SERVICES GROUP (SMC) FINAL REMEDIAL INVESTIGATION REPORT, DATED DECEMBER 23, 1992.

2.) GEOLOGIC CONTACTS ESTABLISHED BY FIELD RECONNAISSANCE GEOLOGIC MAPPING, AND CORRELATION OF BOREHOLE LITHOLOGIC AND GEOPHYSICAL LOGS PROVIDED IN THE DECEMBER 23, 1992 RI REPORT.

3.) WATER LEVELS COLLECTED IN MARCH 1992 BY SMC DURING NON-PUMPING CONDITIONS.

JUL 01 1994

REV	DATE	DESCRIPTION	DR BY	CHK BY	RVW BY

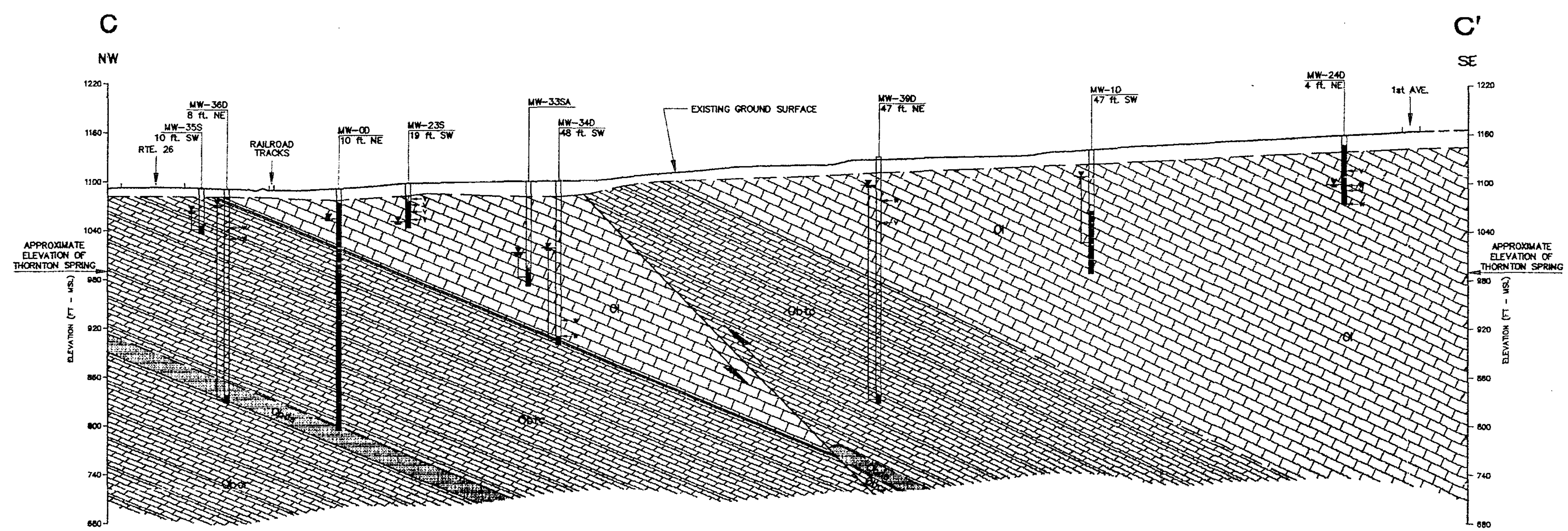
PROJECT: RNC RUETGERS-NEASE CORPORATION FEASIBILITY STUDY STATE COLLEGE, PENNSYLVANIA

SHEET TITLE: GEOLOGIC CROSS SECTIONS A-A' AND B-B'

PROJECT No.	923-6112		FILE No.	PA17-190
CLIENT PROJ. No.			DRAFTING SUBTITLE	02
DES BY	JLH	05/07/93	SCALE	AS SHOWN
DR BY	LRH	09/14/93		
CHK BY	DMC			
RVW BY	PSC	10/15	FIGURE 2-4	

Golder Associates
Mt. Laurel, New Jersey

AR308481



C 2-1 2-4 GEOLOGIC CROSS SECTION C-C'

60 0 60 120
scale feet

LEGEND

- CROSS SECTION DESIGNATION
- FIGURE No. WHERE CROSS SECTION IS PRESENTED
- FIGURE No. WHERE LOCATION OF CROSS SECTION IS FIRST SHOWN

MW-38D — BOREHOLE LABEL
7 ft. NE — PROJECTED DISTANCE

- TOP OF BOREHOLE
- MONITORING INTERVAL
- BOTTOM OF BOREHOLE

FEATURES ENCOUNTERED DURING DRILLING OF BOREHOLE

W = WATER
V = VOID
F = FRACTURE
S = SOLUTIONING
C = SECONDARY CALCITE
Vu = VUGS
Fe = IRON STAINING

SURFICIAL SOIL: UNDIFFERENTIATED COLLUVIUM AND FILL

Ol — LOYSBURG GROUP: GRAY LIMESTONE AND DOLOMITIC LIMESTONE

Obtc — TEA CREEK MEMBER OF THE BELLEFONTE DOLOMITE: FINE GRAINED, MEDIUM LIGHT GRAY DOLOLUTITE

Obcr — COFFEE RUN MEMBER OF THE BELLEFONTE DOLOMITE: INTERBEDDED FINE TO MEDIUM GRAINED DOLOMITE

Obds — DALE SUMMIT MEMBER OF THE BELLEFONTE DOLOMITE: FINE TO COARSE GRAINED CONGLOMERATE SANDSTONE

WATER LEVEL (MEASURED MARCH 1992)

THRUST FAULT SHOWING SENSE OF MOVEMENT

LITHOLOGIC CONTACT (DASHED WHERE INFERRED)

REFERENCE

1.) BOREHOLE LITHOLOGIC LOGS AND MONITORING WELL CONSTRUCTION LOGS OBTAINED FROM APPENDIX C OF THE SMC ENVIRONMENTAL SERVICES GROUP (SMC) FINAL REMEDIAL INVESTIGATION REPORT, DATED DECEMBER 23, 1992.

2.) GEOLOGIC CONTACTS ESTABLISHED BY FIELD RECONNAISSANCE GEOLOGIC MAPPING, AND CORRELATION OF BOREHOLE LITHOLOGIC AND GEOPHYSICAL LOGS PROVIDED IN THE DECEMBER 23, 1992 RI REPORT.

3.) WATER LEVELS COLLECTED IN MARCH 1992 BY SMC DURING NON-PUMPING CONDITIONS.

JUL 0 1 1994

REV	DATE	DESCRIPTION	DR BY	CHK BY	RVW BY

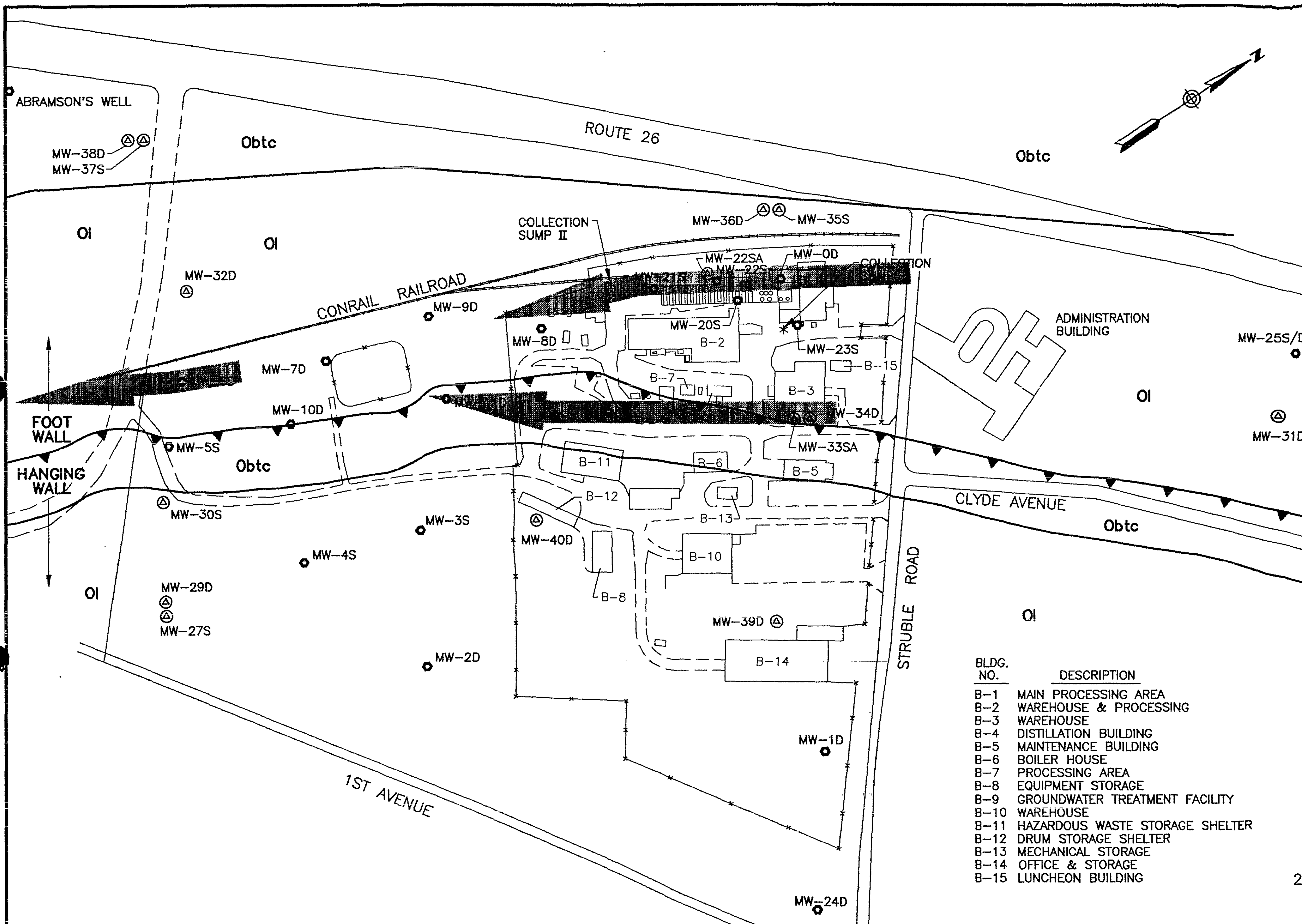
PROJECT: RNC RUETGERS-NEASE CORPORATION FEASIBILITY STUDY STATE COLLEGE, PENNSYLVANIA

SHEET TITLE: GEOLOGIC CROSS SECTION C-C'

Golder Associates
Mt. Laurel, New Jersey

PROJECT No.	923-6112		FILE No.:	PA17-191
CLIENT PROJ. No.			DRAFTING SUBTITLE:	02
DES BY	JLH	05/07/93	SCALE:	AS SHOWN
DR BY	MRM	10/14/93		
CHK BY	JFC		FIGURE 2-5	
RVW BY	PCG	10/15		

AR308482



LEGEND

MW-35S	PHASE I & II MONITORING WELL (S) SHALLOW (D) DEEP
MW-2D	EXISTING MONITORING WELL (S) SHALLOW (D) DEEP (S/D) MONITORS 2 ZONES
*	GROUNDWATER COLLECTION SUMP
	CYCLONE FENCE
	RAILROAD TRACKS
B-6	BUILDING
OI	LOYSBURG GROUP OF LIMESTONES
Obtc	TEA CREEK MEMBER OF THE BELLEFONTE DOLOMITE
	THRUST FAULT
	GENERALIZED FLOW PATH

BLDG. NO.	DESCRIPTION
B-1	MAIN PROCESSING AREA
B-2	WAREHOUSE & PROCESSING
B-3	WAREHOUSE
B-4	DISTILLATION BUILDING
B-5	MAINTENANCE BUILDING
B-6	BOILER HOUSE
B-7	PROCESSING AREA
B-8	EQUIPMENT STORAGE
B-9	GROUNDWATER TREATMENT FACILITY
B-10	WAREHOUSE
B-11	HAZARDOUS WASTE STORAGE SHELTER
B-12	DRUM STORAGE SHELTER
B-13	MECHANICAL STORAGE
B-14	OFFICE & STORAGE
B-15	LUNCHEON BUILDING

NOTES

1.) PUMPING TESTS WERE PERFORMED IN WELLS MW-7D AND MW-OD. FOR THESE TESTS, SEVERAL OTHER WELLS WERE USED AS OBSERVATION WELLS AND WATER LEVELS WERE MONITORED. STRONG RESPONSES WERE OBSERVED IN WELLS ALONG THE THREE GENERALIZED FLOW PATHS INDICATED ABOVE. OTHER WELLS RESPONDED, BUT WITH MORE SUBDUED CHANGES. THESE OTHER WELLS WERE LIKELY CONNECTED TO A MAJOR NORTH-SOUTH CONDUIT SYSTEMS BY A SECONDARY SYSTEM OF VOIDS AND/OR FRACTURES WITHIN THE LOYSBURG LIMESTONE WEDGE. ALL OF THESE CONDUITS MAY BE INTERCONNECTED.

JUL 01 1994

200 0 200
scale feet

JOB No.:	923-6112	SCALE:	AS SHOWN
DR BY:	WME	DATE:	10/14/93
CHK BY:	gfc	FILE No.:	PA17-148
REV BY:	PSR	DR SUBTITLE:	02

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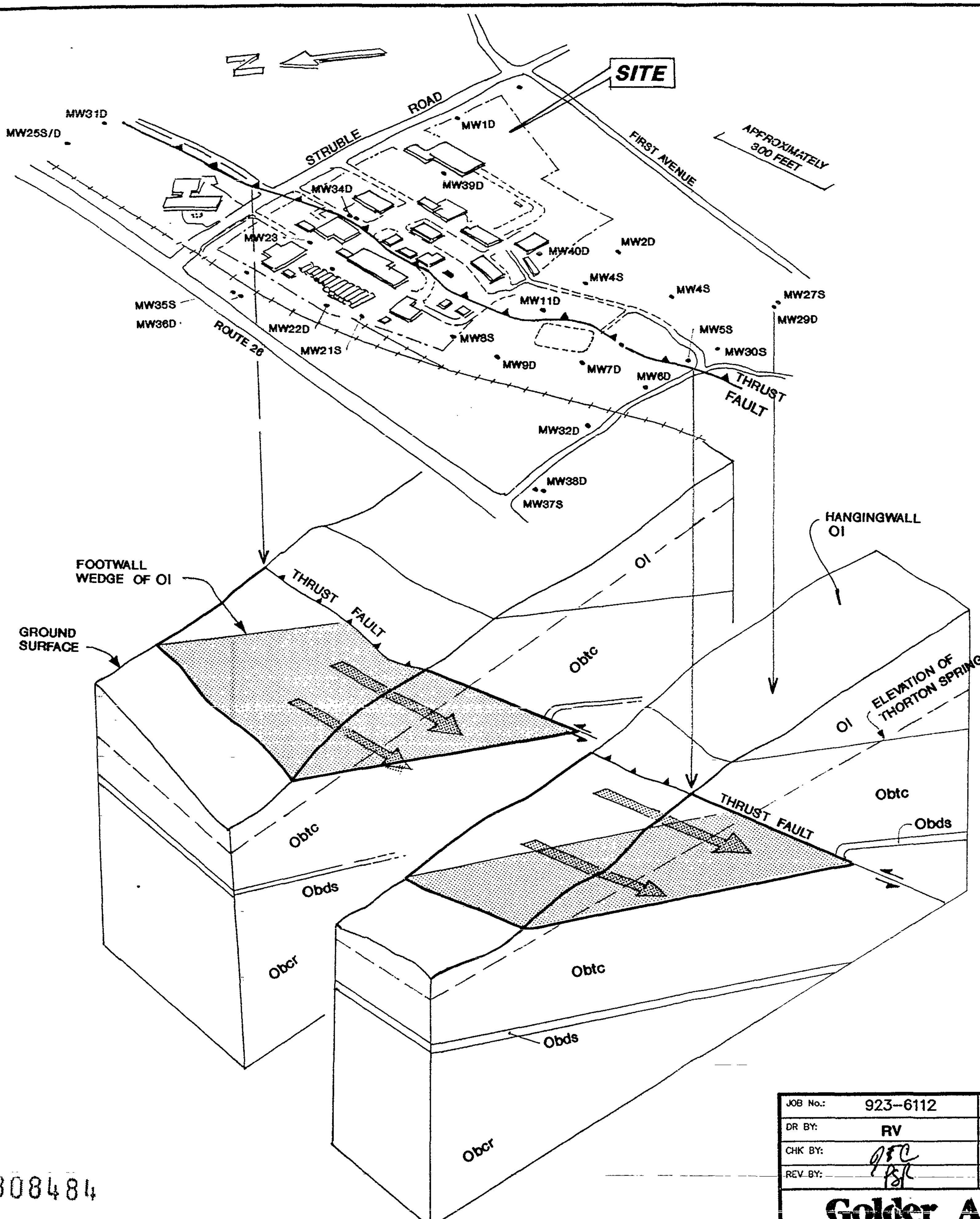
GROUNDWATER FLOW ZONES BASED ON WELL RESPONSES TO PUMPING TESTS

RUETGERS-NEASE CORPORATION

FIGURE 2-8

AR308483



LEGEND

• MW27S — MONITORING WELL

GEOLOGIC UNITS

	OI	LIMESTONES OF LOYSBURG GROUP
BELLEFONTE DOLOMITE	Obtc	TEA CREEK MEMBER
	Obdc	DATE SUMMIT SANDSTONE MEMBER
	Obcr	COFFEE RUN MEMBER

THRUST FAULT
(SAW TEETH ON HANGING WALL BLOCK)

MAJOR GROUNDWATER FLOW ZONES
IDENTIFIED BY WELL RESPONSES
DURING PUMPING TESTS

NOTES

1.) VERTICAL AND HORIZONTAL SCALES ARE APPROXIMATE.

2.) PUMPING TESTS PREVIOUSLY PERFORMED BY SMC ENVIRONMENTAL SERVICES GROUP.

JUL 0 1 1994

AR308484

JOB No.:	923-6112	SCALE:	AS SHOWN
DR BY:	RV	DATE:	06/10/93
CHK BY:	JFC	FILE No.:	PA17-154
REV BY:		DR SUBTITLE:	02

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CONCEPTUAL HYDROGEOLOGIC BLOCK DIAGRAM

RUETGERS-NEASE CORPORATION

FIGURE 2-10